Comparing Changes in Applied Water Use and the Real Gross Value of Output for California Agriculture: 1967 to 2007

A look at the rising economic efficiency of California agricultural water use

A Draft Paper by Jim Rich, Economist, DWR, DPLA. August 4, 2009

Executive Summary

The real, inflation-adjusted gross revenue for California agriculture increased about 84 percent between 1967 and 2007, from $19.9 billion (in 2007 dollars) to $36.6 billion. During that period the total California crop applied water use fell by 14.6 percent, from 31.2 million acre-feet in 1967, to a preliminary, unofficial estimate of 26.7 MAF in 2007.

The rising real value of our agricultural output, coupled with falling crop water use, has more than doubled the "economic efficiency" of agricultural water use in California during the past 40 years. In 1967 there was $638 (in 2007 dollars) of gross agricultural revenue produced in California for each acre-foot of applied water. By 2007 this measure had risen to $1,373/AF. That represents a 115 percent increase in 40 years. Much of this increase has occurred since 2000.

Introduction

In 2008 and 2009, much of California agriculture experienced significant negative impacts from the drought and water shortages. On June 4, 2008, our Governor issued an Executive Order "proclaiming a statewide drought". The Order directed DWR to help alleviate drought impacts and to "work with CDF&A, … and others … to identify and gather data on crop losses and other adverse economic impacts caused by the drought."[1]

However, some in the environmental community have claimed that the most effective drought response would be for California agriculture to stop wasting water, increase its water conservation efforts, reduce the acres planted to "lower-value, water-intensive crops",[2] and increase the acres of higher-valued crops which use less water.

Representatives of the California agricultural community, as well as State government officials, have disputed these contentions of inefficient agricultural water use. For instance, in a recent editorial, CDF&A Secretary A.G. Kawamura wrote:

California farmers have always practiced innovative water resource management, while producing food that feeds the state and the world. Over the past four decades, the amount of

[1] DWR Press Release, "Governor Proclaims Drought, …", 6/4/08.

[2] *More with Less: Agricultural Water Conservation and Efficiency in California, Executive Summary*; H. Cooley, et al; Pacific Institute, 9/08, p. 8.

water used on California farms is relatively consistent, while crop production has increased more than 85 percent. … [3]

DWR economists have analyzed how over the past 40 years the real value of California agricultural output has changed with respect to the water applied to California farmland. Livestock and livestock products were included in this analysis, because the vast majority of California's animal-based agriculture depends, in part, on our irrigated crops.

Economic Analysis

Department economists estimate that over the past 40 years the economic efficiency of water use by California agriculture has more than doubled. The analysis is detailed in a draft spreadsheet, *GAR v AW 67 07 JR 309.xls*, which is available upon request. Here is a summary of the results:

The values in Page A of the spreadsheet are based on water use estimates from DWR Bulletins 160-70, 160-74, and 160-05; 12/08 estimates of 2005 California total and unit applied water use from DWR Land & Water Use Scientists; and crop acreage and gross agricultural revenue estimates from CDF&A and USDA reports for 1967, 1972, 2000, 2005 and 2007. The following table is based on the above spreadsheet:

Year	Gross Agricultural Revenue $ Billions (CY $'s)	Gross Agricultural Revenue $ Billions ('07 $'s)	Total Crop Applied Water Millions of AF	Gross Ag. Revenue/ AF of AW $/AF ('07 $'s)
1967	3.97	19.9	31.2	638
1972	5.1	20.3	31.7	639
2000	27.2	32.6	31.1	1,048
2005	32.4	34.3	27.30	1,258
2007	36.6	36.6	26.66	1,373
% Increase:				
'67 to '05	716.1	72.5	-12.5	97.2
'05 to '07	13.0	6.6	-2.4	9.1
'67 to '07	821.9	83.8	-14.6	115.2
'67 to '00	585.1	63.7	-0.3	64.2
'00 to '07	34.6	12.3	-14.3	31.0

We can see that the real, inflation-adjusted gross revenue for all of California agriculture increased 83.8 percent between 1967 and 2007, from $19.9 billion (expressed in 2007 dollars) to $36.6 billion. However, during that same time period, the estimated total crop applied water use in California fell by 14.6 percent, from 31.2 million acre-feet in 1967,

[3] "Californians need to worry about food security"; *San Francisco Chronicle*; 11/30/08.

to a preliminary rough estimate of about 26.7 MAF in 2007. (For details on how these estimates were calculated, please refer to the above spreadsheet.)

Total crop applied water use varies significantly from year-to-year, depending not only on how many acres of which crops are grown, but also on the weather in California's major growing regions. Estimated total crop applied water use increased 1.6 percent between 1967 and 1972, and fell by 0.3 percent between 1967 and 2000.

Total gross crop revenue varies as crop acres, yields, and prices change over time. Gross revenues from animal agriculture also vary. These trends combined to produce an increase in real annual agricultural gross revenue of about 64 percent between 1967 and 2000. Then the rate of increase slowed slightly, and real agricultural gross revenue per year increased about 12.3 percent between 2000 and 2007.

Because of the rising value of agricultural output, coupled with falling crop water use, the "economic efficiency" of agricultural water use in California more than doubled during the past 40 years. Specifically, in California in 1967 there was $638 (in 2007 dollars) of gross agricultural revenue produced for each acre-foot of water applied to crops. By 2007 this measure of the economic efficiency of agricultural water use in California had risen to $1,373/AF. That represents a 115.2 percent increase in 40 years. California agriculture is producing a lot more real gross revenue, using less applied water.

Note also how this trend appears to have accelerated sharply between 2000 and 2007. During the 33 years between 1967 and 2000, real gross agricultural revenue per acre-foot of applied water increased about 64 percent, from $638/AF to $1,048/AF. Then the shift out of lower-valued field crops, and into riskier, higher-valued truck, tree, and vine crops really took off. (Although such crops may bring in more average gross revenue per acre, they are subject to overproduction and sharp market swings, sometimes resulting in large net losses for the farmers who grow them.) Between 2000 and 2007 real gross agricultural revenue per acre-foot of applied water increased about 31 percent, from $1,048/AF to $1,373/AF.

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